

TRANSPORTATION FACILITIES

Exell Helium Plant

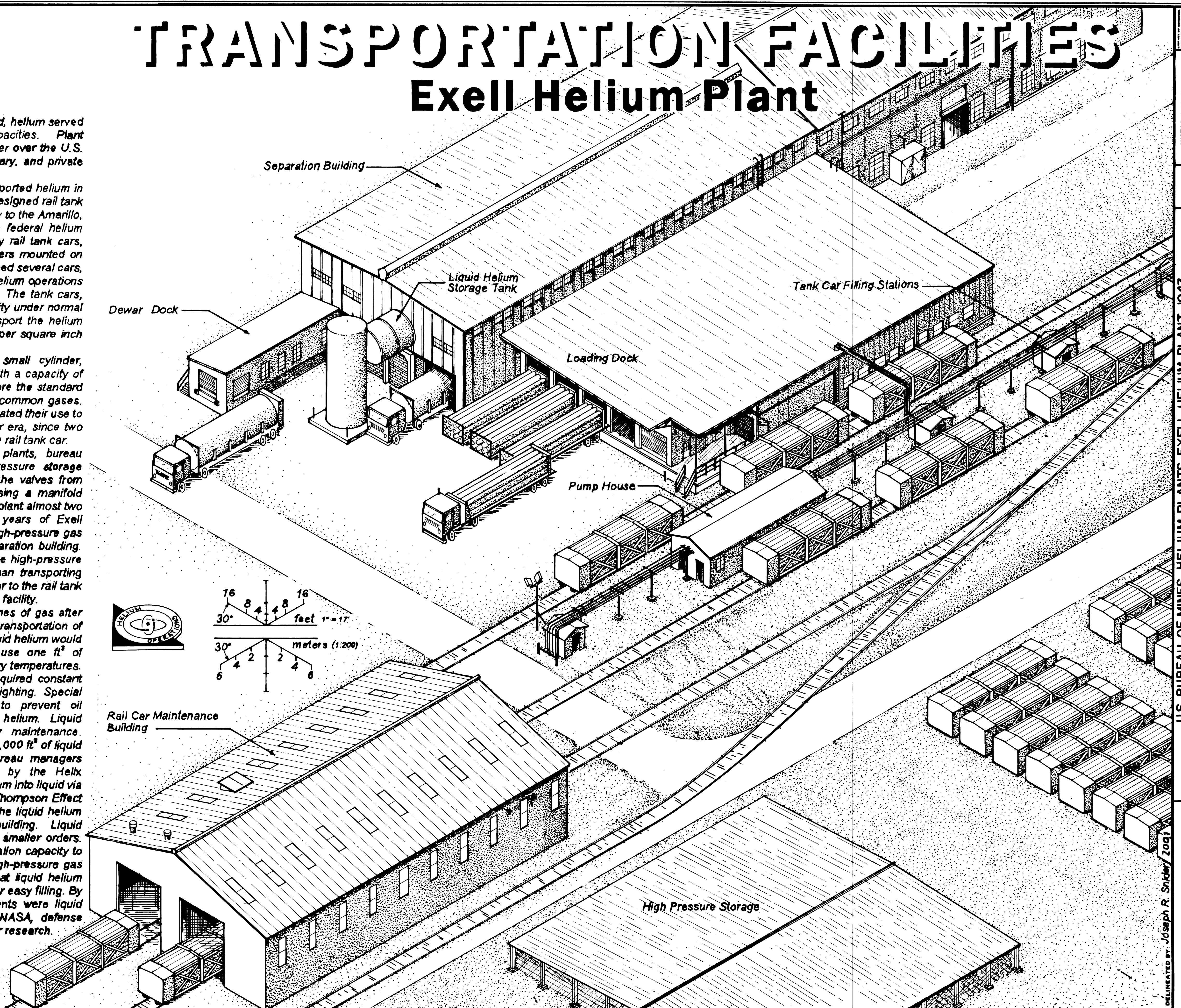
During World War II and the Cold War that followed, helium served the U.S. national defense program in various capacities. Plant operators initially shipped their product by rail, and later over the U.S. interstate highways, to NASA, the AEC, the U.S. military, and private defense contractors.

Prior to the 1950s, the U.S. Bureau of Mines transported helium in two types of containers: small cylinders and specially designed rail tank cars. The rail spur from the Rock Island line ran directly to the Amarillo, and later the Exell, loading dock. Beginning with the federal helium program in 1929, the bureau pressed Navy and Army rail tank cars, consisting of three or more heavy-walled, steel cylinders mounted on railroad trucks, into service. In the 1930s, the Navy owned several cars, while the Army had two. Three decades later, federal helium operations listed 233 such units valued at more than \$20 million. The tank cars, which held 200,000 to 215,000 cubic feet (ft³) of capacity under normal atmospheric conditions, were built specifically to transport the helium under a constant pressure of 2,000 to 2,500 pounds per square inch (psi).

Another preferred freighting medium was the small cylinder, normally loaded onto railroad boxcars for delivery. With a capacity of 178 ft³ of helium at 1,800 psi, the smaller cylinders were the standard shipping vessel for hydrogen, oxygen and other more common gases. The inefficiency of these small cylinders, however, relegated their use to second-class status for the remainder of the Cold War era, since two boxcars of smaller cylinders equaled the capacity of one rail tank car.

To provide storage for purified helium at the plants, bureau scientists designed and constructed special high-pressure storage facilities. Engineers at the Amarillo plant removed the valves from 24,000 small cylinders, and then connected them using a manifold system of tubing. This single unit allowed the Amarillo plant almost two months total storage capacity. During the first 35 years of Exell operations, most of the helium was shipped from the high-pressure gas storage and loading dock on the west side of the separation building. Rail tank cars were sometimes filled directly from these high-pressure storage units. Sometime in the late 1950s, Exell began transporting helium gas in over-the-road trailers that had tanks similar to the rail tank cars; they too were filled from the high-pressure storage facility.

Concerned about the cost of shipping large volumes of gas after World War II, Dr. Clifford W. Seibel contemplated the transportation of helium in liquid form. In the 1960s, he predicted that liquid helium would revolutionize all previous methods of delivery, because one ft³ of vaporized liquid helium equaled 754 ft³ of gas at ordinary temperatures. In addition, both small cylinders and rail tank cars required constant maintenance to prevent helium from escaping during freighting. Special cleaning and maintenance crews were required to prevent oil contamination, which might ruin an entire shipment of helium. Liquid trailers and shipment required much less regular maintenance. Although the Amarillo plant did fill orders of less than 2,000 ft³ of liquid helium in the 1960s, it was not until 1980, that bureau managers installed the first helium liquefier. Manufactured by the Helix Technology Corporation, this vessel processed gas helium into liquid via high-speed turbines, heat exchangers, and the Joule-Thompson Effect (JT Effect). Once liquefied, the helium was stored in the liquid helium tank located in the north section of the separation building. Liquid dewars of 100 to 500-liter capacity were used to fill smaller orders. Larger orders required trailers with 11,000 to 15,000-gallon capacity to be delivered via highways. Located adjacent to the high-pressure gas storage, the liquid helium tank was constructed so that liquid helium trucks could pull into the building right below the tank for easy filling. By the mid-1990s, roughly 20 percent of Exell's shipments were liquid helium. The bulk of Exell's liquid helium supplied NASA, defense contractors, and universities engaged in superconductor research.



U.S. BUREAU OF MINES, HELIUM PLANTS, EXELL HELIUM PLANT 1943

HELIUM ACTIVITIES RECORDING PROJECT
UNITED STATES DEPARTMENT OF THE INTERIOR

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